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Investigation of the Effect of Aluminum Alloy Position on ResidualStresses in Dissimilar fsw Weld by Using the Ultrasonic Method

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Abstract: The main goal of this study is to show the effect of the advancing side (AD) and theretreating side (RT) position on the Residual stresses and local mechanical behaviour ofdissimilar friction stir welds of aluminum alloys AA2024-T3 and AA7075-T6. Different sampleswere produced by varying the rotational speed of the tool (1200 and 1400 rpm) and the alloyposition regarding the advancing side of the tool. Ultrasonic Method has been used to evaluateResidual Stresses. This method is based on the acoustoelastic effect, which measures the velocityvariation of the elastic waves according to the stress state of the material. This can be achievedthrough a calibration test, which permits the determination of the acoustoelastic coefficient (K).The results show a tensile stress in the Nugget (N), the heat affected zone (HAZ) and acompression stress in the base metal (BM). Increasing the rotational speed reduces the amplitudeof the longitudinal residual stresses with a high reduction in the case where AA7075 - T6 is inthe advancing side whit 1400 rpm. This has been directly associated to the increase in the heatinput and the reduction of the thermal mismatch between different areas of the weld. Themicrostructure effect of aluminum alloy position acts on the acoustoelastic constant K. Thechoice of t0 corrects the overestimated residual stresses in the (HAZ) and (N).

Keywords : FSW, contraintes résiduelles, microstructure, comportement mécanique, corrélation d'image numérique